

AUTHOR INDEX

A

Abell, G. O., 1-22; 1, 2,
6, 7, 8, 9, 10, 13, 14,
16, 18
Abt, H. A., 257, 258, 262
Ahrens, L. M., 221
Alder, K., 82, 83
Alfvén, H., 208, 299, 300
Ali, A. W., 74
Allen, C. W., 85, 179, 240,
367, 368
Allen, L. R., 240
Aller, L. H., 42, 48, 156,
157, 159, 160, 167, 168,
179, 220, 221, 238, 270
Ambartsumian, V. A., 11,
12, 13
Ames, A., 4
Anders, E., 221, 226,
229
Anderson, C. A., 226
Armstrong, B. H., 77, 86
Arnold, J. R., 218
Arnulf, A., 23
Arp, H. C., 265, 270
Arpigny, C., 351-76;
351, 353, 357, 358, 359,
360, 361, 362, 363, 365,
366, 367, 368, 370, 371,
372, 374
Artsimovich, L. A., 298
Athay, R. G., 168, 202,
205
Avrett, E. H., 35, 163, 180,
185, 195, 196, 200, 201
Axford, W. I., 51, 52

B

Baade, W., 3, 275, 300
Babcock, H. W., 263
Bahner, K., 28, 38, 41,
43, 44
Ballik, E. A., 371
Bappu, M. D. V., 255
Baranger, M., 71, 72, 74,
77, 80, 81, 82, 83, 84,
85, 86, 89
Barbanis, B., 120, 122
Barbier, D., 23, 35, 148
Barrett, A. H., 289
Barthle, R. C., 391
Baschek, B., 37, 38, 168,
178, 198
Bates, D. R., 91, 179, 368
Baum, W. A., 5, 8, 265
Bay, Z., 391
Beileke, F., 23
Benediktov, E. A., 328

Berg, H. F., 74
Berger, J., 38, 41
Bergstedt, K., 77
Bertiau, F. C., 252
Bideiman, W. P., 248,
260, 262
Biermann, L., 67, 357,
358, 372
Biraud, F., 285, 286
Birkhoff, G. D., 113, 122,
128
Blauw, A., 252, 253
Blamont, J. E., 151
Bless, R. C., 38, 42
Blevins, B. C., 391
Blitzstein, W., 399
Block, N., 387, 400, 404,
406, 407
Bogen, P., 73
Böhm, K. H., 71, 148, 192,
205, 206, 210
Böhm-Vitense, E., 188,
189, 206
Bohr, A., 82, 83
Boisshot, A., 299
Boldt, G., 74, 89
Bolton, J. G., 280, 293,
294
Bonnet, R., 151
Bonsack, S. J., 37
Bosman-Crespin, D., 374
Bötticher, W., 179
Bowles, K. L., 399, 400
Boyartchuk, A. A., 168
Braude, S. Ya., 342
Brecht, S., 80, 84, 85,
88
Breen, F. H., 178
Breene, R. G., 71, 90
Brillouin, L., 148
Brouw, W. N., 300
Brown, H., 225
Brown, M. S., 227
Brown, R., 240
Bruton, R. H., 391
Buckingham, R. A., 179
Burdidge, E. M., 12, 168,
235, 240, 242, 244
Burbridge, G. R., 12, 50,
166, 219, 235, 240, 242,
244
Burgess, A., 179
Burke, B. F., 275-96;
285, 286, 289
Byram, E. T., 237, 238,
269
C

Callomon, J. H., 368

Cameron, A. G. W., 217,
227
Cameron, R., 248
Camm, G. L., 114, 119
Canavaggia, R., 151, 162,
164, 165, 238
Cane, M., 201
Carpenter, R. L., 18, 399,
400, 401, 403, 407
Carrier, G. F., 185
Carrington, T., 360
Cayrel, G., 163, 168
Cayrel, R., 91, 161, 163,
187, 188, 192, 198, 204
Cayrel de Strobel, G.,
38
Chalone, D., 23, 28, 35,
38, 41, 148, 150, 151,
179
Chandra, S., 255
Chandrasekar, C., 313
Chandrasekhar, S., 12,
113, 115, 170, 171, 178
Chapman, J. H., 391
Chavira, E., 253
Chen, S., 71
Chubb, T. A., 237, 238,
269
Clark, G. W., 299
Clemence, G. M., 93-112;
96
Climenhaga, J. L., 369,
370
Code, A. D., 23, 25, 28,
42, 237, 240, 269
Condon, E. U., 88
Conti, P. S., 163
Contopoulos, G., 117, 119,
120, 122
Coolidge, A. S., 368
Cooper, B. F. C., 281,
283, 285
Cooper, W. S., 74, 89
Courtes, G., 370
Craig, H., 221, 223
Craig, K. J., 391
Crawford, D. L., 255,
257
Crocker, E. A., 391, 394
Cuny, Y., 206

D

Dalgarno, A., 91, 180
Damgaard, A., 91
Daniels, F. B., 394
Davidson, C., 23
Davies, R. D., 67
Davis, J., 240
Débarat, S., 156

AUTHOR INDEX

- Debuic, A., 163
 De Carl, P. S., 226
 de Jager, C., 150, 162
 165, 168, 207, 208
 Del Duca, B., 357
 DeMarque, P. R., 241,
 244, 269
 Denisse, J. F., 299
 Dennisson, E., 5
 de Sitter, W., 96
 de Vaucouleurs, A., 237
 de Vaucouleurs, G., 4, 6,
 8, 18, 406
 Deutsch, A. J., 206, 261
 DeWitt, J. M., Jr., 391
 Dickey, R. H., 387
 Dickens, R. J., 270
 Dieter, N. H., 289
 Ditchburn, R. W., 179
 Divan, L., 38, 41, 165
 Dombrowski, V. A., 299,
 300
 Dorsey, N., 108
 Dossin, F., 351
 Doyle, R., 179
 Drake, F. D., 276, 281,
 322
 Drawin, H. W., 89
 Dufay, J., 359, 371
 Duke, M. B., 218, 223,
 229, 230, 231
 Dumont, S., 143, 144, 152
 Duncombe, R. L., 404
 Dunkelman, L., 33
 Dyce, R. B., 391, 392,
 394
 Dyson, F. W., 23
 Dyson, J. E., 47-70
- E
 Ecker, G., 72
 Eddington, A. S., 118, 119
 Edmonds, F. N., 168
 Eggen, O. J., 235-74;
 235, 240, 241, 244, 247,
 248, 253, 259, 260, 262,
 263, 266, 267, 268, 269
 Eidman, V. Ya., 331
 Elste, G., 168
 Elton, R. C., 74
 Epstein, S., 218, 223,
 229, 230, 231
 Eucken, A., 230
 Evans, D. S., 255, 258
 Evans, J. V., 391, 393,
 394, 395, 399
 Evans, S., 391
 Evans, T. L., 260
 Ewen, H. I., 289
- F
 Faulkner, D. T., 42, 238
 Feautrier, P., 179, 190,
 201
 Fehrenbach, C., 351, 355,
- 370, 372
 Feige, J. A., 43
 Feinstein, A., 258
 Ferguson, E., 76, 77, 78,
 79, 87
 Firor, J. W., 285, 286
 Fischer, D., 35, 163, 180,
 198, 206, 210
 Flather, E., 49
 Fleischer, R., 43
 Fontana, P. R., 91
 Fowler, W. A., 227
 Fredriksson, A., 391
 Fredriksson, K. J., 218
 Fricker, S. J., 391
 Fringant, A. M., 38
 Frisch-Piron, H., 205
 Froome, K. D., 403
- G
 Gardner, F. F., 67, 289,
 293, 294
 Garstang, R. H., 367, 368
 Gascoigne, S. C. B., 237
 Gaustad, J. E., 172, 176,
 177, 186, 187, 238, 239,
 246
 Gebbie, K. B., 163, 201
 Gelman, S., 152, 178
 Getmanshev, G. G., 298,
 299, 328
 Gilby, A. C., 368
 Gilmore, W. F., 399, 402
 Gingerich, O. W., 163,
 177, 178, 179, 180, 196,
 198, 201
 Ginsburg, V. L., 297-50;
 297, 298, 299, 300, 306,
 307, 326, 327, 328, 338,
 339, 342, 344, 345
 Giovannelli, R. G., 209
 Giver, L. P., 37, 41, 42
 Glushneva, I. N., 38
 Goldberg, L., 179
 Goldschmidt, V. M., 221
 Goldstein, R. M., 380,
 399, 400, 401, 402, 403
 Goldstein, S. J., 293
 Goldsworthy, F. A., 51,
 55, 65
 Goles, G. G., 231
 Golomb, S. W., 391, 392
 Gordon, I. M., 298, 299,
 300
 Gould, R. J., 50
 Greaves, W. M. H., 23
 Green, P. E., 384, 395
 Greenland, P., 219, 222
 Greenstein, J. L., 227,
 270, 351, 353, 355, 365,
 371, 372
 Grieg, D. D., 391
 Griem, H. R., 71, 72, 73,
 74, 76, 77, 80, 81, 82,
 83, 84, 85, 86, 87
 Grossmann, K., 193
- Groth, H. G., 168
 Grudzinska, S., 373
 Gunderman, E. J., 293
- H
 Haddock, F. T., 328
 Hagen, J. P., 276
 Hagfors, T., 394
 Halldinger, W., 218
 Hall, J. S., 23
 Hansen, C. F., 86
 Hardie, R. H., 247
 Harding, G. A., 271
 Hardrop, J., 168
 Hargreaves, J. K., 391
 Harm, R., 261
 Haro, G., 253
 Harris, D. L., 85, 88
 Harris, D. L. III., 41
 Haser, L., 351, 353
 Haskin, L., 231
 Hayakawa, S., 338
 Hayashi, C., 248, 254,
 261, 263
 Hayli, A., 123, 129
 Hazard, C., 240
 Heiles, C. E., 133, 392
 Heintze, J. R. W., 207, 208
 Henon, M., 133
 Henry, J. C., 289, 392, 395,
 398
 Henryey, L. G., 241, 242,
 244, 247, 253
 Herbig, G. H., 253, 254
 Herlofson, N., 298, 299, 300
 Herman, L., 89
 Herzberg, G., 358
 Herzog, E., 1, 9
 Hey, J. S., 391
 Hill, E., 118
 Hill, E. R., 299
 Hiltner, W. A., 265
 Hindmarsh, W. R., 90
 Hodge, P., 8
 Hofmeister, E., 248
 Hogbom, J. A., 341
 Hogg, A. R., 255
 Holdridge, D. B., 387,
 400, 404, 406, 407
 Hollinger, J. P., 281, 284
 Holmberg, E., 4, 6, 8
 Holstein, T., 72
 Holtsmark, J., 72
 Horl, G., 119, 124
 Hoshi, R., 261, 263
 Hoyle, F., 64, 217, 227,
 238
 Huang, S-S., 179
 Hubble, E., 5, 6, 14
 Hubenet, H., 207, 208
 Hughes, V. A., 391
 Humason, M. L., 4, 7
 Hummer, D., 146
 Hunzerts, J., 359, 360,
 365
 Hunger, K., 35, 162, 168

- Hunter, J. H., 258
 Husus, T., 82, 83
- I
- Iben, I., 247
 Imrie, K. S., 400, 407
 Ingallis, R. P., 391, 399, 400
 Inglis, D. R., 77
 Iriarte, B., 235, 248
- J
- James, H. M., 368
 James, J. C., 399, 400
 Jamieson, J. C., 226
 Janaky, K. G., 275
 Jeans, J. H., 114, 118
 John, T. L., 178
 Johnson, H. L., 45, 235, 240, 248, 253, 255, 265, 270
 Joy, A. H., 271
 Jugaku, J., 161, 163, 168, 178, 262, 263
- K
- Kahn, F. D., 47-70; 61, 64
 Kardashev, N. C., 339
 Karp, D., 399, 400
 Karzas, W. J., 178
 Kavanaugh, R. W., 85
 Kegel, W. H., 168, 201
 Kell, K., 216, 223, 225, 226
 Kennedy, G., 226
 Kerr, F. J., 289, 292, 391, 398
 Kharitonov, A. V., 28, 41
 Kienle, H., 23
 Kiepenheuer, K. O., 296, 299, 300
 Kingston, A. E., 91
 Kinman, T. D., 269
 Kippenhahn, R., 248
 Kivel, B., 79
 Klemperer, W. K., 399, 400
 Kodaira, K., 168
 Koehler, J. A., 12
 Kohl, K., 168, 198
 Kolb, A., 72, 73, 80, 81, 82, 83, 84, 85, 86, 87
 Korchak, A. A., 298, 318, 322
 Kotelnikov, V. A., 399, 400, 401, 402, 403, 404, 406, 407
 Kourganoff, V., 148, 150, 170, 179, 183
 Kraft, R., 250
 Krassovsky, V. I., 32
 Kron, E., 358
 Kron, G. E., 240, 263
- L
- Labs, D., 180
 Laloux, R., 144
 Landau, L. D., 298, 303, 306, 307
 Larson, R. B., 241, 244, 269
 Latham, R. W., 201, 210
 Latimer, W. M., 222
 Latter, R., 178
 Layzer, D., 16
 Leadabrand, R. L., 391
 Lecar, M., 193, 198, 206
 Lefevre, J., 150, 206
 LeLevier, R., 241, 242, 244, 253
 Lequeux, J., 282, 285, 286
 Leroux, E., 285, 286
 Lessham, K., 179
 Levee, R. D., 247, 253
 Lewis, M., 71, 76, 77, 80
 Lifshitz, E. M., 298, 303, 306, 307
 Liller, M. H., 5
 Liller, W. C., 23, 25
 Lilley, A. E., 276, 293
 Limber, D. N., 12, 15
 Lincke, R., 74
 Lindholm, B., 118, 253
 Lindholm, E., 79
 Loeser, R., 200, 201
 Losovsky, B. Y., 392
 Lovasz, J. L., 3
 Low, F. J., 45
 Luchak, G., 399
 Lucy, L., 193, 198
 Lundblad, R., 154
 Lynden-Bell, D., 118, 120
 Lynch, G., 255
 Lynn, V. L., 391, 394
- M
- McClain, E. F., 276
 McCullough, T. P., 300
 McDonald, J., 162
 McGee, R. X., 293, 294
 McKellar, A., 360, 370
 McNamara, D. H., 247
 MacRae, D. A., 43
 Magnan, C., 204
 Mahan, J., 372
 Margenau, H., 71, 80
 Maron, I., 399
- Marr, A. V., 179
 Martin, E., 23
 Mason, B., 219, 223
 Mason, W. C., 391
 Matsushima, S., 179, 198, 200
 Mayall, N. U., 3, 4
 Mayer, C. H., 300
 Mazing, M. A., 71
 Meadows, A. J., 260
 Meeks, M. L., 289
 Melbourne, W. G., 37, 38, 166
 Menneret, C., 38
 Menon, T. K., 51, 56, 57
 Menzel, D. H., 178, 406
 Menzies, A., 255, 258
 Metzger, S., 391
 Michard, R., 151, 183
 Miffin, R., 394
 Mihalas, D., 35, 40, 163, 177, 198
 Miller, F. D., 373
 Milligan, J. E., 45, 198, 237
 Mills, B. Y., 277, 278, 279
 Milne, E. A., 174
 Minkowski, R., 84
 Minnaert, M. G. J., 144, 197
 Minnett, H. C., 275
 Mitchell, R. I., 45, 248, 253, 255
 Mitchell, W. E., 178
 Moiseiwitsch, B. L., 88
 Moore, C. E., 178
 Morgan, H. R., 109
 Morgan, W. W., 258
 Morguleff, N., 23
 Morrison, P., 299
 Morrow, W. E., Jr., 399, 400
 Moser, B., 72
 Mottelson, B., 82, 83
 Moussilic, L., 144
 Mozer, B., 72, 73, 74, 77
 Muhleman, D. O., 387, 394, 400, 401, 404, 406, 407
 Muller, C. A., 60
 Muller, E. A., 179
 Muller, K. G., 72
 Munch, G., 180, 183, 184
 Murray, B. C., 45, 225
 Murray, C. A., 267
 Murray, W. A. S., 391
 Mustel, E. R., 185
- N
- Neven, L., 162, 163, 165, 168, 201
 Newcomb, S., 93, 94, 95, 109
 Neyman, J., 3, 12, 13, 15
 Nguyen, H., 89

- Nichipurok, W., 230
 Nishimura, S., 64
 Noonan, T., 2, 3, 12, 13
 Norton, R., 42, 236
- O
- Ochs, G. R., 399, 400
 O'Dell, C. R., 269
 Oertel, G., 80, 81, 82, 83,
 84, 85
 Ohman, Y., 359
 Ohmura, H., 178
 Ohmura, T., 178
 Oke, J. B., 23-46; 28, 37,
 41, 42, 163, 167, 237
 Olehy, D. A., 231
 Ollongren, A., 113-34;
 114, 115, 117, 118, 119,
 120, 122, 123, 124, 125,
 126, 127, 128, 129, 133
 Omer, G. C., 2
 Oort, J. H., 60, 64, 109,
 118, 276, 289, 299, 300
 Upik, E. J., 217
 Osawa, D., 35, 40, 162,
 179
 Osterbrock, D. E., 49,
 367, 368, 369
- P
- Page, T., 2, 12
 Pagel, B., 150, 151, 205
 Pannekoek, A., 76, 185
 Paquette, D. R., 74
 Parigasky, Y. N., 285
 Parker, R. A. R., 58, 59
 Partsch, P., 218
 Pawsey, J. L., 299
 Pecker, J. -C., 135-216;
 136, 137, 142, 143, 144,
 146, 147, 150, 151, 152,
 155, 160, 162, 164, 165,
 175, 180, 188, 189, 196,
 201, 204, 208, 210, 211,
 238
 Peimbert, M., 269
 Pekeris, C. L., 178
 Pengelly, R. M., 87
 Penner, S. S., 85
 Penzias, A. A., 293
 Pepin, J., 227, 228
 Perek, L., 133
 Peterson, D. M., 133
 Petrie, R. M., 247
 Pettengill, G. H., 377-10;
 391, 392, 393, 394, 395,
 396, 399, 400, 404, 405,
 407
 Peyturaux, R., 150
 Piddington, J. H., 275
 Pierce, A. K., 150, 156,
 164
 Pikelner, S. B., 299, 336
 Pomeranchuk, I. Ya., 298
 Ponsomby, J. E. B., 399,
- 400, 404, 407
 Poots, G., 368
 Popper, D. M., 41, 42,
 263, 270, 271
 Pottasch, S. R., 48, 50
 Potter, A. E., 357
 Praderie, F., 179
 Presnell, R. I., 391
 Preston, G. W., 267
 Price, R. M., 281, 283,
 285, 398, 399
 Prior, G. T., 219, 223
 Przybylski, A., 144, 162,
 194, 265
- R
- Rabe, E., 110, 403
 Ramsay, D. A., 371
 Razin, V. A., 300, 343
 Rea, D. G., 394
 Reaves, G., 4, 8, 14
 Reber, G., 275
 Redman, R. O., 142
 Reid, S., 179
 Remy-Battiau, L., 372
 Reynolds, J. M., 218, 227
 Ringwood, A. E., 219
 Rittmann, A., 230
 Roberts, J. A., 299
 Robinson, B. J., 12, 289,
 293, 294
 Roddier, F., 208
 Rodgers, A. W., 42
 Roger, R. S., 399, 400
 Roman, N. G., 285
 Rose, W. K., 45
 Roseland, S., 136, 178
 Rougoor, G. W., 276, 281,
 289, 290
 Rudkjøbing, M., 79, 81,
 162, 185
 Ryle, M., 299
- S
- Saari, J. M., 398
 Saito, S., 162, 178, 238
 Sanchez, A. D., 392, 394
 Sandage, A. R., 4, 166,
 235, 240, 242, 244, 266,
 267, 268, 269, 270
 Sanival, N. B., 255
 Sargent, W. L. W., 38,
 58, 258, 262, 263
 Scanlon, T. F., 391
 Shahmaneche, F., 23
 Schiff, L. I., 298
 Schlüter, A., 67
 Schlüter, H., 76, 77, 78,
 79, 87
 Schmidt, M., 116, 118, 119,
 123, 124
 Schmitt, R. A., 231
 Schott, G. A., 298
 Schroter, E. H.,
 208
- Schuller, F., 90
 Schulte, H. F., 328
 Schwarzschild, K., 358
 Schwarzschild, M., 45, 261
 Schwinger, J., 298
 Scolnik, R., 33
 Scott, E. L., 3, 12, 13,
 15
 Seares, F. H., 14
 Searle, L., 37, 38, 41,
 42, 163, 167
 Sears, R. L., 248
 Seaton, M. J., 49, 64, 82,
 84, 87, 163, 179, 201,
 357
 Seeger, Ch. L., 300
 Seyfert, C. K., 275
 Shain, C. A., 391
 Shakeshaft, J. R., 341
 Shane, C. D., 1, 15
 Shapiro, I. I., 377-10;
 387, 388, 390, 400, 403,
 404, 405, 406, 407, 408
 Shapley, H., 1, 4, 7
 Shefov, N. N., 32
 Shen, K. Y., 72, 73, 74,
 86, 87
 Shkolnik, I. S., 298, 299,
 300, 341
 Shorthill, R. W., 398
 Shortley, G. H., 88
 Shuter, W. L. H., 67
 Siegel, C. L., 122
 Signer, P., 238
 Silver, L. J., 218, 229,
 231
 Silver, L. T., 223, 230
 Sinhval, S. C., 255
 Slater, C. H., 67
 Sliah, V. I., 343
 Sloanaker, R. M., 300
 Smak, J., 248, 250
 Smart, W., 113
 Smerd, S. F., 299, 328
 Smith, R. H., 231
 Smith, W. B., 399, 400,
 401, 406, 407
 Sobelman, I., 79, 80, 81
 Sobolev, V. V., 171
 Sohigian, M. D., 391, 394
 Solarski, J. E., 74
 Solomon, P. M., 179
 Solomonovich, A. E.,
 392
 Spence, R., 179
 Spitzer, L., 3, 59, 68, 71,
 238, 239
 Stawikowski, A., 351, 359,
 367, 371
 Stebbins, J., 263
 Stecher, T. P., 45, 198,
 237
 Steinberg, J. L., 282
 Steinlin, V., 1
 Steinmetz, D., 248
 Stevens, R., 391, 392,
 399, 400

- Steward, A. L., 179
 Stibbs, D. W. N., 189
 Stockhausen, R. E., 367,
 368, 369
 Stodola, E. K., 391
 Stone, M. L., 391
 Stone, P. H., 172, 176,
 177, 186, 187
 Stone, Y. H., 38
 Stoy, R. H., 255, 258
 Strassl, H., 23
 Strom, S. E., 35, 43, 180,
 198, 200
 Strömgren, B., 48, 61,
 157, 160, 162, 179, 235,
 238, 260, 262
 Struve, O., 255
 Suess, H. E., 217-34;
 219, 220, 223, 224, 227,
 228, 229
 Sugimoto, D., 261,
 263
 Swanson, M. D., 15
 Sweet, P. A., 65
 Swift, D. W., 381
 Swihart, T. L., 35, 182,
 192, 194, 210
 Swings, P., 351, 353, 355,
 358, 359, 360, 365, 366,
 367, 370, 371, 372, 374
 Sykes, J. B., 143
 Syrovatkin, S. I., 297-50;
 298, 299, 318, 322, 338,
 339, 344, 345
- T
- Takayanagi, K., 64
 Takeo, M., 71
 Taylor, G. N., 390, 400
 Taylor, H. P., Jr., 218,
 223, 229, 230, 231
 Teller, E., 77
 Terashita, Y., 200
 ter Haar, D., 217
 Thomas, R. N., 137, 168,
 202, 205
 Thompson, T. W., 392,
 394
 Thomson, J. H., 391, 399,
 400, 407
 Thorne, K. S., 322
 Tift, W. G., 268
 Tinbergen, J., 300
 Torgård, I., 123, 124,
 125, 126, 127, 128, 129
 Travling, G., 71, 91, 167,
 168
 Treffz, E., 357, 358,
 372
 Trehan, S. K., 115
 Trexler, J. H., 391
 Troitsky, V. S., 392
 Tuve, M. A., 289
 Twersky, V. J., 392
- U
- Ueno, S., 171, 178, 179
 Underhill, A. B., 35, 72,
 76, 162, 163, 179, 194,
 198, 201, 211
 Unno, W., 208
 Unsöld, A., 23, 71, 78, 91,
 157, 168, 183, 192, 299
 Urey, H. C., 217, 218, 219,
 220, 221, 222, 223, 225,
 226, 229, 230, 231
- V
- Vainshtein, L. A., 79, 80,
 81
 Van Albada, G. B., 119
 van Damme, K. J., 12,
 289, 293
 van de Hulst, H. C., 60,
 120, 125
 van den Bergh, S., 13
 Vandervoort, P. O., 55,
 57
 Van Dien, E., 166
 van Maanen, A., 253
 Van Remerhorst, H., 71-92;
 76, 80, 85, 88, 152, 165,
 166, 179, 208
 Van't Veer, C., 165, 167,
 168
 Van't Veer, F., 151
 Vardya, M. S., 164, 179,
 180, 210
 Vashakidze, M. A., 299,
 300
 Verschuur, G. L., 67
 Victor, W. K., 391, 392,
 398, 400
 Vidal, C. R., 78, 87
 Vitense, E., 152, 157,
 166, 179, 180
 Vladimirski, V. V., 298
 Voigt, H. H., 208
 Von der Pahlen, E., 113
- W
- Waddell, J. H., 76, 150,
 156, 164
 Waer, R., 391
 Wallerstein, G., 38, 248,
 269
 Walraven, T., 299, 300
 Walsh, D., 328
 Wilke, H., 228
 Warneck, P., 372
 Warner, B., 372
 Watson, K., 225
 Wayman, P. A., 255, 258
 Weaver, H. F., 260
 Weidemann, V., 91, 168
 Weigert, A., 248
 Weinreb, S., 289
- Y
- Yamashita, Y., 180
 Yaplee, B. E., 391
 Yarin, V. I., 32
- Z
- Zähringer, J., 228
 Zanstra, H., 358
 Zharkov, G. F.,
 306
 Zheleznyakov, V. V.,
 299, 327, 331
 Zwicky, F., 1, 2,
 4, 6, 7, 8, 9,
 13, 16

SUBJECT INDEX

A

Aberration constant, 94,
99, 102, 104, 109
Absolute flux
in stellar spectra, 28-34
Absolute spectral gradient
in stellar spectra, 28
Absolute units, 307
Absorbants
in stellar atmospheres, 177
Absorption
in H II regions, 55
in plasmas in general, 326
Absorption coefficient
gray, 138
of radio waves
in plasmas, 348
Absorption index
see Index of absorption
Absorption lines
in hot stars, 41
in stellar spectra in
general, 35
see also individual elements
and series
Abundances
in comets, 358
in planetary matter, 219
in stellar atmospheres,
154, 161, 164, 167, 211,
260-62, 267
see also individual elements
Accelerating mechanisms
in plasmas, 332
Accelerators
bremsstrahlung in, 298
Accumulation points
of integrals
as criteria in stellar
atmospheres, 117
Acoustic waves
in stellar atmospheres,
136, 202, 210
Adiabatic cooling, 341
Adiabatic invariant, 341
Adiabatic models
of stellar atmospheres,
136
Adiabatic sound speed, 53
Adiabatic theory
of line broadening, 72, 81-
85, 91
AD Per, 250
ADS 9532 Aa, 263
ADS 9532 B, 263
ADS 16644, 270
Alfvén speed
in interstellar medium,
47

American Ephemeris, 93,
94
Ammonia
in planetary matter, 229
Am stars, 37, 262, 263
Amplitude of oscillation
of electromagnetic
radiation, 314
 α And, 259, 263
 γ And, 257
Angular momentum integral,
115
Anisotropic velocity dis-
tribution of electrons
effects on polarization, 318
measure of, 323
Antenna beamwidth, 277
Antenna gain
in radar work, 386
Antenna temperature, 277
Ap Stars, 37
in clusters, 258-63
 γ Aquilae, 37, 41
105 Agr, 259
 Ar^{36} - Ar^{38} ratio
in planetary matter, 228
Arecibo Ionospheric
Observatory, 379, 381,
398
Argon
in stars, 91
Array techniques
in radio astronomy, 277
A stars
atmospheres, 155, 165,
179, 211
calibration sources, 29
giants, 37, 38, 39, 43
Asteroids
see Planetary objects
Astronomical constants,
93-112
Astronomical unit, 99, 101,
103, 108
radar determinations of,
387, 403-4
Atmospheric absorption
effect on radar, 380
in stellar spectra, 29,
32-33
Atmospheric dispersion
effects on stellar spectra,
24
Atmospheric emission, 32
Atmospheric extinction
effect
on counting of galaxies,
9
on stellar spectra, 32
 α Aur, 244

ζ Aur, 204
 η Aur, 240, 257
 θ Aur, 259
Autocorrelation function
in radar, 391
in stellar atmospheres,
206
Available measure
of orbit, 129
Avrett-Krook method
for stellar atmospheres,
195, 196-97, 198
Axisymmetric galaxy
orbits in, 113, 118

B

Background radiation
correction for
in stellar spectra, 34
Balloon measurements
of stellar spectra, 45
Balmer discontinuity
in stellar atmospheres,
164, 198
in stellar spectra, 28, 41,
43
as function of temperature,
gravity, 35, 36, 37
Balmer lines
for measurement of
electron density in H
II regions, 49
in stellar atmospheres
156, 165, 166, 167, 180,
208
in stellar spectra, 32
high lines, 77-78, 86, 87
line profiles, 74, 76
Bandwidths
in stellar spectra, 29
criteria for selection,
30
Banger impact theory
for line broadening, 71,
72, 74, 81, 82, 85
Barium
in planetary matter, 231
Bates and Damgaard
Coulomb hydrogenic
approximation, 91
Binary stars
in galactic clusters, 241
in stellar spectra
for determining tempera-
ture scale, 34
subdwarf, 269
Birkhoff's last problem, 113
Bismuth
in planetary

- matter, 222
 Bjurbäck meteorite, 223
 Black-body calibration
 of stellar spectra, 23
 Black-body model
 of stellar atmospheres,
 137, 138-39
 Blanketing effect, 166, 172,
 198, 204
 Blocking effect
 of line absorption, 166
 Bohm's method
 in stellar atmospheres,
 192, 205
 Bohm-Vilense's analysis
 of stellar atmospheres,
 188, 189-90, 206
 Bohr magneton, 368
 Bolometric correction,
 235, 238, 240, 247,
 248
 Boltzmann equation
 in plasmas, 115
 Boltzmann excitation probability
 in comets, 360
 in H II regions, 60
 in stellar atmospheres,
 152, 157, 171
 α Boo, 240
 σ Bootes, 38, 240
 Born approximation, 79
 Boundary conditions
 in stellar atmospheres,
 176-77
 Boundary curve
 in orbit theory, 122
 Bound-free processes, 298
 in stellar atmospheres,
 172, 178
 Box orbits
 in orbit theory, 123-25
 Brackett series, 76
 Bremsstrahlung
 see Electron bremsstrahlung;
 Magnetonbremsstrahlung
 Brightest galaxy criterion
 for clusters of galaxies,
 7
 Brightness temperature,
 277, 278
 British Nautical Almanac,
 94
 Bromine
 in planetary matter, 230
 Brown's tables of astronomical constants,
 105
 B stars, 251, 259
 atmospheres, 155, 165,
 167
 calibration in stellar spectra,
 28, 35, 38, 41,
 43
 in H II regions, 47
 BU Per, 250
- C
 3C273, 299
 Ca I
 in planetary matter, 231
 in stellar atmospheres,
 156, 157, 179
 see also Calcium
 Ca II
 in stellar atmospheres,
 156, 157, 202, 204, 205,
 253, 267
 Ca II lines, 32
 in stellar atmospheres,
 202, 204
 Cadmium
 in planetary matter, 229
 Calcium
 line production, 84, 90
 Calibration of spectra
 by standard stars, 27-34
 accuracy, 28
 Callisto
 radar observations, 380
 Calorimetric methods
 in radar, 386
 Canonical equations
 in stellar orbit theory,
 114
 α Car, 239
 Carbon
 in comets, 352, 353, 355,
 357, 367-71, 373
 in meteors, 219, 222,
 228, 229
 ratio of Cl² to Cl³
 in comets, 371
 in stellar atmospheres,
 155, 164, 179
 Carbonaceous chondrites,
 219, 221, 223, 229
 Carbon-burning stage, 257,
 261, 271
 Carbon dioxide
 in comets, 372
 in planetary matter, 222,
 229
 in stellar atmospheres,
 180
 Carbon monoxide
 in planetary matter, 229
 Carrier-Arvett method
 in stellar atmospheres,
 185
 Cartesian coordinates
 in stellar orbit theory,
 119
 ϵ Cas, 240
 σ Cas, 257
 ω Cas, 257
 Cassiopeia A
 as a radio source, 288,
 293, 299, 338, 341
 Cassiopeia-Taurus
 association, 252
 Catastrophic energy losses,
 337, 339
- Cathode calibration
 for stellar spectra, 25-26
 \times Cen, 257
 ω Cen, 270, 271
 3 Cen A, 168, 257, 262
 Centimeter wavelengths
 observations
 of galactic nucleus, 286,
 287
 Central galactic source,
 281, 285, 286, 287
 Central limb intensity
 in model atmospheres,
 200, 208
 Centrifugal force
 in particle orbit theory,
 115
 Centripetal force
 in particle orbit theory,
 115
 δ Cephei, 37, 41
 Cepheids
 in evolutionary theory,
 248, 249, 250, 271
 spectral energy distribution, 37
 γ Cephei group, 267
 Cerenkov radiation, 324-
 25
 Cesium
 line broadening, 84
 δ Cet, 168
 σ Cet, 248
 Chain of islands
 in stellar orbit theory,
 133
 Chalcophile elements
 in planetary matter, 220,
 221
 Chalone discontinuity,
 165
 Chandrasekhar mean,
 183, 184, 196
 Chandrasekhar's method
 for stellar atmospheres,
 194-95, 196
 Characteristic frequency
 for bremsstrahlung
 radiation, 348
 Characteristics
 method of
 for expansion of gas
 cloud, 57
 Characteristic time
 for bremsstrahlung losses, 348
 for collisions
 see Collision time
 Chemical composition
 of solar system, 217-34
 of stars
 effects on atmospheres,
 156, 158, 161, 167,
 168, 198
 effects on spectra, 35,
 37
 in observational

SUBJECT INDEX

- theories of evolution, 247
Chlorine
in planetary matter, 230
Chromospheric regions,
136, 157, 161, 167,
201-5
Chondrites, 216, 219, 221,
223, 226, 230
Circular polarization
criterion for, 308
signal advantages, 385
Classical path theory
of electron impacts, 73,
89
Cluster evolution, 254
Cluster formation, 63
Cluster hypothesis, 9, 15
Cluster integral expansion
in electron line broadening, 72
Clusters of galaxies, 1-22
cluster cells, 1
colors, 5-11
distribution, 14-20
dynamics, 11-14
equipartition of energy
in, 14
formation, 11
gravitational forces, 11
higher-order clustering,
19
irregular, 1-2
luminosities, 5-8
mass-luminosity ratio,
12
morphology, 1-11
permanence, 11
populations, 8-11
regular, 1-2
surveys of, 1
see also Coma cluster
 α CMa, 168, 240, 263,
265
 β CMa, 237
 ϵ CMa, 237
 ζ CMa, 240
 κ CMa, 240
 α CMI, 168
 β CMI, 240
 κ Cnc, 259
Coarse analysis, 145, 152,
154, 156-60
Cobalt
in planetary matter, 220
Coherent emission, 206
 α Col, 257
Collapsed stars
in nebulae, 345
see also Neutron stars
Collisional dissociation
in comets, 357
Collisional heating
of interstellar medium,
81
Collisional line broadening,
72
see also Electron line
broadening
Collisional processes
in stellar atmospheres,
172, 204, 206
Collisional wing formation
of lines in stellar atmospheres, 156
Collisions
in clusters of galaxies, 3
Collision time scale
of electrons in H II regions, 49
of particles in comets,
357
Color indices
of galaxies, 8
Color-luminosity relation,
247, 248, 253, 254,
265, 270
Color temperature
for exciting star in H II region, 54
for stellar atmospheres, 139
21 Com, 259
Coma, 365, 372
see also Comets
Coma Berenices cluster,
260
Coma cluster of galaxies,
2-3
angular size, 2
classification, 2
collisions in, 3
distance modulus, 2
evolutionary processes
in, 3
field galaxies in, 2
interstellar matter in
galaxies of, 3
luminosity function, 7
mass-luminosity ratio, 3
red shifts of galaxies,
2-3
Sculptor-type galaxies in,
5
spiral galaxies in, 3
Cometary spectra, 351-74
observations of, 351-55
Atlas of Cometary Spectra, 353-55
theory of, 356-74
carbon, 367-71
excitation mechanisms,
356-59
internal motion effects,
365-67
resonance fluorescence,
359-65
some other emissions,
371-74
Comets
Halley's, 358
heads, 351, 352, 359
Humason, 372
Ikeya, 353, 356, 368,
371, 373
Mrkos, 351, 353, 363,
364, 365, 367, 368,
372, 373
Seki-Lines, 353, 365,
368, 372
see also Heliocentric
distance; Heliocentric
radial velocity
Compact clusters, 9
see also Regular clusters
Comparison star
see Standard star
Compression of interstellar
gas
by clouds in collision,
61
Compton energy, 307
Compton losses, 339
Compton scattering, 326
Condon parabola, 359
Conducting media, 332
Conductivity
electrical
of interstellar plasma,
67
thermal
of planetary surfaces,
391, 398
Configuration space,
115
see also Phase space
Conjugate momenta, 113-14
Conservation
of flux
in stellar atmospheres,
174
Conservation condition
on transition probability,
73
Conservation equations
across I fronts, 51
Conservative integral, 117
Conservative system, 115
Constants
astronomical, 93-112
Contact transformations
in stellar orbit theory,
120
Continuity equations
in H II regions, 55
in stellar orbit theory,
113-17
Continuous spectrum
scanning, 29
Continuous-wave transmitters, 380, 383
Continuum
radio spectrum, 277-88
visible spectrum
pressure effects, 154
Convection
in stellar atmospheres,
209, 210
effects on spectra,
35

- Conversion of energy
in H II regions, 54-55
Convolution formula, 143
Cooling rate
in H I region, 60-61
in H II region, 50-51
Cool stars
atmospheres, 167
spectral energy distribution, 37-43
Corona Borealis cluster
of galaxies, 13
Coronal atmospheres, 161,
201
bremsstrahlung in, 298,
326, 342
radio observations
of solar atmosphere,
377, 388
Corpuscular radiation
and comets, 358
Correlation curves
in stellar atmospheres,
208
Cosmic ray electrons
in astrophysical plasmas
in general, 278
in radio sources, 333-35
Cosmic ray flux, 67
Cosmic rays
in bremsstrahlung sources,
333-37
electron component,
333-35
proton and nuclear component,
338
Cosmological principle
evidence for, 15
Coudé spectrograph
in cometary spectra, 381
Coulomb fields
in electron line broadening,
72, 78, 87
Coulomb-hydrogenic
approximation, 91
Coupled oscillators
in stellar orbit theory,
122-23
Crab nebula
optical observations, 344
radio observations, 278,
288, 299, 300
Craters
see Rayed craters; Tycho
 β Crib, 259, 265
Cross section
for interaction
in electron-H II regions,
49
in electron impact theory, 73
in stellar atmospheres,
179
radar, 378, 383, 386,
390, 398, 401
lunar, 392-94
 β Cru, 257
- i CruB, 259
Curvature of layers
in model atmospheres,
157
Curves of growth
of interstellar lines, 61
of stellar lines, 158,
208
Cyclic coordinates, 113
Cyclotron frequency, 278,
307
Cyclotron radiation, 301-2
 α Cyg, 168
31-32 Cyg, 204
61 Cygni group, 267
Cygnus loop, 58-59, 64
Cylindrical coordinates
in stellar orbit theory,
114
- D
- Dalgarno relation, 180
Damped oscillators, 323-
34
Damping constant
in line broadening
due to neutrals, 90
Danjon astrolabe, 100
Debye-screened fields
in electron line broadening, 72
Defining constants, 101
Degrees of polarization,
317, 322, 323
Deimos
radar observations, 380
Delay depth
radar, 394
Delay-Doppler dispersion,
383, 384, 385, 390,
407
Density
of matter
in comets, 351
in interstellar medium,
61
in universe, 19
Density criterion
in stellar atmospheres,
172
Density fluctuations
in space
as galaxies, 15
as measure of electron density in H I region,
60
as measure of electron density in H II region,
49
Depolarization, 327
of radar signals, 394,
398
Depth of formation method, 144-45
Detectability
of radar signals, 378-79
- Developable integral, 120
D front, 51, 54
Diamonds
in meteorites, 218, 226
Dielectric constants
of planetary surfaces
by radar, 396, 391, 392
Differential corrections
to system of astronomical constants, 101, 106
Diffusion coefficient
for electron energy,
337, 340
Diffusion time, 340
Dilation
effect
on stellar spectra, 141
Dipole approximation
in electron impact theory,
73, 81, 86, 88-89, 91
Dipole magnetic fields,
322, 323
Dipole moment
see Magnetic dipole moment
Dipole radiation, 301, 368
Directional couplers
in radar, 386
Directivity
of radar signals, 390
Discontinuity treatment
of I front
validity, 52
Discrete fluctuations
of matter density, 15
Discrete ordinates
method of, 184, 192
Discrete radio sources
at galactic nucleus,
282-83
magnetobremssstrahlung
in, 333-43
Disk
stars, 211, 269
radio observations, 299
Dispersion
see Atmospheric dispersion
Dispersion ring
of stellar velocities, 253
Dispersive power
of gratings, 24
Distribution of clusters
of galaxies, 14-20
discrete fluctuations,
15
map, 17
dKe, 204
D lines of sodium
in stellar spectra, 32
see also Sodium
Doppler broadening, 85
Doppler effect on frequency
anomalous, 325
in medium, 324-25
ordinary and

SUBJECT INDEX

- relativistic, 303
 Doppler shifts
 in galactic hydrogen, 276,
 289, 294
 radar measurements, 383-
 84
 second-order, 406-7
 α Dor, 259
 73 Dra, 259
 Dust
 absorption of atoms onto,
 60
 extinction by, 49
 tracers of magnetic fields,
 66
 DW Per, 250
 Dynamical equilibrium
 in interstellar plasma, 68
 Dynamical form factor, 103
 see also Form factor
 Dynamics
 of clusters of galaxies,
 11-14
 of H II regions, 54-57
 DY Peg, 268
- E
- Early-type stars
 in clusters, 257
 in the interstellar medium
 as energy sources, 47
 spectra, 32, 34, 41, 42
 Earth
 atmosphere, 377
 eccentricity of orbit, 104
 equatorial radius, 98, 101,
 109
 external potential, 96
 flattening, 95, 102, 104
 gravitational field, 96, 104
 interior constitution, 96,
 226
 magnetic field, 298, 322
 mass, 102, 103, 104
 -Moon mass ratio, 97, 99,
 101, 102, 105
 -Sun
 mass ratio, 102, 105
 distance, 104, 107, 108
 -Venus distance, 108, 383
 Eccentricity
 of Earth
 see Form factor
 of planets, 379
 Echo delay
 in radar, 380
 Eclipses
 lunar and solar
 data for, 95
 of Sun
 as used in stellar atmospheres, 151
 Eclipsing binary
 data
 for stellar atmospheres,
 151, 158
 for stellar evolution, 247
 Ecliptic
 see Obliquity of ecliptic
 Eddington approximation,
 173-74, 181, 183, 185,
 186, 189, 190, 196,
 206, 209
 Eddington-Barbier relations, 144
 Eddington's "fountain model"
 of comets, 365
 Eddington's theorem, 118
 Effective gravity
 of a star
 in atmospheres, 156, 161,
 177, 182
 in spectra, 35
 Effective temperature
 in stellar atmospheres,
 139, 158, 161, 164,
 166, 170, 177, 182
 in stellar spectra, 34-37
 Einstein relation
 for emission and absorption, 328-29
 Einstein's theory of relativity
 see General relativity
 Elastic scattering of electrons
 in electron line broadening, 88
 see also Electron impact broadening
 Electrical conductivity
 of interstellar plasmas, 67
 Electromagnetic energy
 from neutron stars, 64
 in plasmas, 323-32
 see also Radiation
 Electromagnetic separation
 of elements in stars, 261
 Electron bremsstrahlung
 component of cosmic rays
 in discrete radio sources,
 333-35
 from ensembles of electrons, 313-23
 from individual electrons,
 300-13
 angular distribution, 309
 ultrarelativistic, 303-5
 Electron broadening of spectral lines, 71-72
 combined with ion broadening, 85-86
 see also Electron impact broadening
 Electron density
 in H II regions, 48-49
 optical measurements,
 48
 radio measurements, 48
 in plasmas
 see plasmas
 Electron impact broadening
 for nonhydrogenic atoms,
 76-86
 Electron pressure
 in stellar atmospheres,
 152, 154-56, 169, 182
 Electron temperature
 in H II regions, 49-51
 Ellipsoidal velocity distributions, 119, 120
 Ellipsoid of revolution
 see Reference ellipsoid
 of revolution
 Elliptical galaxies
 in clusters, 2
 magnitudes, 7
 Elliptical polarization
 of bremsstrahlung radiation, 306, 317, 318
 of interstellar radiation,
 67
 Elliptic coordinates
 in stellar orbit theory,
 119, 120
 Ellipticity
 of Earth
 see Form factor
 of Earth's orbit, 104
 of polarization ellipse,
 316
 Emission lines
 in comets, 351
 in radio galaxies, 275
 in stellar spectra, 29, 33
 see also particular elements
 and lines
 Emission measure
 in radio work, 287
 Emission nebulae, 341
 Emission spectra
 of discrete radio sources,
 337-43
 Empirical models
 of stellar atmospheres,
 142-54
 Encounter hypothesis
 of formation of galactic objects, 11
 Encounters
 in stellar orbit theory, 113
 Energy balance
 for H II regions, 50
 Energy conservation
 across I fronts, 51
 Energy conversion
 see Conversion of energy
 Energy flux
 in stellar atmospheres,
 170
 Energy integral, 116, 120
 Ensemble bremsstrahlung
 radiation, 317, 318
 Enstatite chondrites, 219,
 222
 Enthalpy
 in ionization fronts, 52
 Ephemeris, 93,
 94

- Ephemeris second, 103
 see also Second
 Ephemeris time, 96
 γ Equ., 259, 265
 Equation of radiative transfer, 170, 172-73
 Equations of motion
 in stellar orbit theory, 113-17
 Equation of state
 in stellar atmospheres, 155
 Equilibrium
 in stellar orbit theory, 115
 Equilibrium temperature
 of H II region, 50
 Equinox
 mean, 103
 Equipartition of energy
 in clusters of galaxies, 14
 Equipotential curves
 in stellar orbit theory, 116
 Ergodic integral, 117
 α Eri, 257
 36 Eri, 259
 Euler gamma function, 319
 Europa
 radar observations, 380
 Evolution
 of stars
 see Stellar evolution
 Evolutionary tracks of stars, 244, 248
 "Exact" methods
 for model atmospheres, 145-47
 Excitation mechanisms
 in comets, 356-59, 360
 Excitation potential
 of line, 151
 Excitation state of atoms
 in stellar atmospheres, 158
 Excitation temperature
 in stellar atmospheres, 158
 Excitation transition
 in H II regions, 50
 Existence theorem
 for transformations, 125
 Extended radio sources, 281, 286, 288, 299
 bremsstrahlung in, 333-35
 Extinction
 in radio observations
 of H II regions, 49
 see also Atmospheric extinction; Grey extinction
 Extraordinary waves, 327
- F
- Fading
- see Interference fading;
 Short-period fading
 Fan beam surveys
 of the galactic center, 285, 286
 Faraday effect, 67
 Faraday rotation, 300
 in radar work, 385, 391
 Fayetteville meteorite, 228
 Feautrier's linearization method
 in stellar atmospheres, 190-92, 206
 Feeder lines
 in radar, 386
 Filamentary structure
 of supernova remnants, 58-59
 Fission formation
 of galaxies, 13
 FK3, 95
 FK4, 95
 Flare stars, 253
 Flow equations
 in H II regions, 54-57
 Flow patterns
 in H II regions, 55
 Fluorescence processes
 see Resonance fluorescence
 Fluorine
 in planetary matter, 230
 Flux
 of radiation, 313-18
 absolute, 28-34
 in stellar atmospheres, 140, 170
 Flux conservation
 across ionization fronts, 51
 in stellar atmospheres, 174-75, 183, 186, 187, 189, 192
 Flux constancy expression, 175-77
 Forbidden lines
 in cluster galaxies, 2
 in comets, 354, 372
 in H II regions, 49
 Formation
 of galaxies
 by encounters, 11
 by fission, 13
 of H II regions, 55
 of solar system
 chemical evidence, 217-34
 of stars
 in the interstellar medium, 62
 of stellar associations
 from the interstellar medium, 63
 Formation layer
 see Mean layer of formation
 Form factor
- for reference ellipsoid, 98, 101
 Fornax cluster of galaxies, 8
 Fourier series representation
 for bremsstrahlung radiation, 307
 Fourier transform techniques
 in line-broadening theory, 85
 in stellar atmospheres, 147, 148, 181
 Fractionation processes, 218, 219, 227-31
 gas-gas, 227-29
 gas-solid, 229-30
 solid-solid, 230-31
 Fraunhofer lines
 in comets, 359, 362-63, 367
 in stellar atmospheres, 208
 Free-free transitions, 298
 in H II regions, 49, 50, 277
 in stellar atmospheres, 161, 172, 178, 179, 201
 Frequency limiting
 in stellar atmospheres, 148
 F stars
 atmospheres, 164, 165, 167, 179
 in evolutionary theory, 259, 260, 267, 271
 spectra, 37, 43
 Fundamental constants, 96
 see also Defining constant; Primary constant
 Fundamental epoch, 103
 Fundamental stars catalog, 95
- G
- Galactic center
 radio determinations, 281-82, 292
 Galactic coordinates, 289
 Galactic disk
 radiation in, 298, 322
 radio observations, 279, 292
 Galactic equator
 distribution of stars, 212, 267
 radio observations, 279, 292
 Galactic expansion
 radio observations, 276, 290-91

SUBJECT INDEX

- Galactic field of force
local, 120
- Galactic halo
radio emission, 299, 335
stellar population, 267
- Galactic magnetic field, 343
- Galactic nuclei
as radio sources, 339
see also specific galaxies
- Galactic nucleus-radio
observations
continuum, 277-88
spectral, 289-95
hydrogen, 289-93
- Galactic rotation
effect
on fundamental constants, 100
radio observations, 276, 290, 291
- Galactic spiral arms
radiation in, 322
see also 4kpc arm; 135 km/sec arm
- Galaxies
clusters of
see Clusters of galaxies
- Galaxy
evolution of, 211
stationary model, 338
stellar orbits in
numerical solutions, 120-33
theory, 113-20
see also Orbit theory
- Gallium
in stars, 362
- Gamma function
see Euler gamma function
- Gamma rays
see Cosmic rays
- Ganymede
radar observations, 380
- Gas pressure
in stellar atmospheres, 154-56, 169
- Gaunt factor, 178
- Gaussian constant of gravitation, 99, 101, 103, 107, 108, 109, 387
- Gaussian line profile, 85
- Gaussian luminosity function for galaxies, 15
- Gaussian units, 307
- Generalized coordinates, 113-14
- General relativity
fourth test, 388-90
- Geocentric constant of gravitation, 99, 103, 108, 109
- Giant stars
atmospheres, 158
in evolutionary theory, 253, 257, 270
- Globular clusters
in cluster galaxies, 8
- stellar population, 261, 267, 269, 271
- Globular clusters of galaxies
see Regular clusters of galaxies
- Gradient of the continuum, 165-66
- Grains
in H II regions, 60
- Granulation
in stellar atmospheres, 208
- Grating spectrograph
in stellar spectra, 24
- Gravitational condensations in Orion nebula, 58
- Gravitational contraction of a star, 253
- Gravitational constant, 99, 101
see also Gaussian constant of gravitation; Geocentric constant of gravitation
- Gravitational effects
in H II regions, 55
in interstellar medium, 65
- Gravitational field
of Earth, 96, 98, 104
of galaxy
see Galactic field
- Gravitational instability in clusters of galaxies, 11
in interstellar medium, 63
- Gravitational waves, 306
- Gravity of stars
in stellar spectra, 35
- Gray-body model
of stellar atmospheres, 137, 138, 161-63, 173, 176, 180-85, 188, 190, 193
- Gray-star approximation, 182
- Greenstein effect, 365, 366, 373
- Grey extinction, 32-33
- Griem, Kolt, and Shen
theory
of line broadening, 72-76
- Groombridge 1830 group, 266-67
- α Gru, 257
- G stars
atmospheres, 165
evolution, 259, 260, 267, 271
spectra, 38, 43
- Gyrofrequency, 278, 326
- H
- $H\alpha$
profiles, 73, 76
solar atmosphere, 91
- H β
index, 247
photometry, 255, 257
profiles, 73, 74, 76
- H γ
observations, 255
profiles, 73, 75, 76, 167
- H δ , 32, 167
profiles, 73, 76
- H ϵ , 32
profile, 73
- Hale telescope
in comet spectra, 351
in stellar spectra, 24
prime focus scanner, 25, 26
- Halo stars, 211, 267, 269
- Hamburg Assembly of the IAU, 93, 106
- Hamiltonian formulation of stellar orbit theory, 114
- Hamilton Jacobi equations, 119
- Harmonic mean temperature
in H I regions, 60
- Harmonic oscillators
in stellar orbit theory, 120-23
- Harmonics
of bremsstrahlung radiation, 307
- Hartree potential, 80
- Harvard-Smithsonian Conference on Stellar Atmospheres, 135, 177, 198, 200
- Haystack facility, 388, 389
- HD 19445, 168
- HD 101065, 265
- HD 103095, 38
- HD 140263, 38, 40, 166, 168
- HD 169882, 269
- HD 169889, 269
- Heating mechanisms
in stellar atmospheres, 136, 202
- Heating rate
of H I region, 61-65
of H II region, 49-50
- Heavy elements
in planetary matter, 219, 230
see also particular elements
- Heliocentric distance
of comets, 382, 383, 389, 370, 373
- Heliocentric gravitational constant, 102, 104, 109
- Heliocentric radial velocity of comets, 359
- Helium
lines, 30, 82, 83, 84, 167, 179
in planetary matter,

- 219, 226
in stellar atmospheres, 164, 179, 262
Helium-burning stage, 250, 261, 263, 271
Helium flash, 261, 270
 ζ Her, 244
 ι Her, 168
 π Her, 257
 ϕ Her, 259
 ω Her, 259
52 Her,
Hercules cluster of galaxies, 2
Hertzsprung-Russell diagram
in stellar spectra, 35
see also H-R diagram
High velocity stars
in evolution theory, 266-67, 271
in orbit theory, 118
Hill's theory of Jupiter and Saturn, 94, 111
Hill's variational orbit for the Moon, 105
Holmium star, 265
Holtsmark theory of line broadening, 71, 72, 76, 85
Homogeneity of distributions of galaxies, 15
of stellar atmospheres, 150
Homonuclear system, 367
Hori's formula
in stellar orbit theory, 124
Hot stars
atmospheres, 164
HR612, 259
HR1029, 258
HR1051, 258
HR1732, 259
HR4817, 259
HR5190, 257
HR5378, 257
HR6997, 257
HR8216, 259
H-R diagram
implications for stellar atmospheres, 154, 155, 158, 211
H I regions, 47, 59-60
H II regions, 47-59
dynamics, 54-56
electron density, 48-49
electron temperature, 49-51
energy sources, 65
formation, 55
galactic center, 277, 278, 280, 283, 285, 288
heating, 49
ionization front, 51-54
Orion nebula, 56-58
Hubble's interpolation formula, 5
Hubble's inverse square law for surface brightness, 5
Hubble's luminosity function for elliptical galaxies, 6
Humason, 372
Hummer's method
in stellar atmospheres, 146
Hyades
in evolutionary theory, 235, 241, 242, 243, 244, 247, 248, 253, 259, 260, 262, 265, 267, 269
in stellar spectra, 37, 39, 40-41, 42
Hydrides
in comets, 367
in planetary matter, 229
Hydrogen
in comets, 368
in galaxy, 269
group of chondrites, 218, 219, 223, 226, 230
in H I regions, 60
lines
broadening, 71-79
of Ca II, 32, 202, 204
in galactic nucleus, 276, 289-93, 298
in hot stars, 30
in stellar atmospheres, 155, 178-79
in stellar spectra, 28, 31, 32, 40
molecular negative ion
in stellar atmospheres, 178
molecular positive ion
in comets, 368
in stellar atmospheres, 178-79
negative ion
absorption of radio waves, 288
in stellar atmospheres, 150, 152, 156, 178, 204
neutral atoms
broadening by, 90-91
in stellar atmospheres, 179
in planetary matter, 219, 222, 225, 226, 229-30, 329
in stellar atmospheres, 178-79, 205
Hydrogen-burning stage, 235, 253, 261, 263
Hydrogenic ions
line profile, 74
Hydromagnetic effects
in interstellar clouds, 68
Hydromagnetic waves
in stellar atmospheres, 136, 202
Hydrostatic equilibrium
in stellar atmospheres, 150, 155, 157, 169, 177, 182, 186, 201
Hyperbolic trajectory
in electron impact theory, 74, 82
I
IC 2602, 255
Ices
in the solar system, 225-26
I front
see Ionization front
Ikeda, 353, 354, 355, 356, 368, 371, 373
Impact broadening
see Electron impact broadening
Impact parameter, 73, 86
Debye cutoff, 87
Impurities
in interstellar medium, 47
Inclination
of orbit, 121, 122
Inclination curve, 121, 123
Inclination diagram, 121-22, 123
Index of absorption, 326
Index of refraction
of plasmas, 323, 326, 331, 343
Indium
in meteors, 219, 222
in planetary matter, 219, 222
Inelastic scattering
of electrons
in electron broadening, 88, 89
see also Electron broadening
Impact theory
Inferior planets, 96, 102, 111
Information theory
in stellar atmospheres, 148
Infrared indices, 240, 265
Infrared measurements
of stellar spectra, 33, 43-45
applied to atmospheres, 151
Inglis-Teller formula, 77
Inhomogeneous fields
bremsstrahlung in, 322-23
Inhomogeneous models
of stellar atmospheres, 207-10
Inner planets, 96, 102, 111
formation, 225-26, 230

SUBJECT INDEX

- see also Inferior planets
Instabilities
 in plasmas, 332
 see also Gravitational instability
Instrumental profile, 166
Instruments
 for stellar spectra, 24-27
Integral of motion, 115-17
Integral relations
 in stellar atmospheres, 151-54
Integrated brightness
 of galaxy, 5
Integrated magnitude
 of galaxy, 6
Intensity
 of radiation
 in magnetobremssstrahlung, 318-22
 in stellar atmospheres, 139-42
Interaction cross section
 see Cross section
Interference fading
 in radar, 391
Interference filters
 in stellar spectra, 27
Intergalactic absorption
 effect on counting, 9, 16, 18
 effect on estimated total energy, 12
 see also Plasmas
International Astronomical Union, 93, 96, 98, 101, 106
 Hamburg Assembly, 93, 106
International Conference on Weights and Measures, 97
International Union of Pure and Applied Physics, 103
Interpenetration
 of interstellar gas and magnetic field, 69-70
Interplanetary medium
 radar studies, 377, 384, 390
Interpolations
 in stellar orbit theory, 123
Interstellar absorption effect
 on galactic cluster population, 8, 9, 15
 on stellar observations, 239
Interstellar grains
 in H I regions, 60
Interstellar magnetic fields, 47, 62, 66-70
 effect
 on H I regions, 67-70
Interstellar medium
- energy and dynamics of, 47-70
 in stellar orbit theory, 113
 see also Plasmas
Interstellar polarization, 86
Invariant points
 in stellar orbit theory, 125
Io
 radar observations, 380
Ion broadening of spectral lines, 72, 77-78
 combined with electron broadening, 85-86
Ionization
 in H II region, 47
Ionization anomalies
 in stellar atmospheres, 164
Ionization balance
 in H II regions, 55
 in stellar atmospheres, 155, 161
Ionization front, 51-55
 discontinuity treatment, 52
 D-type, 53-54
 R-type, 54
 strong cooling in, 51
Ionization state
 of atom
 in atmospheres, 158
Ionization stratification
 in H II regions, 51
Ionosphere
 radar studies, 377, 385
IR observations
 in stellar atmospheres, 152
 see also Infrared
Iron
 in comets, 352
 in planetary matter, 219, 220, 223, 226, 230
 in stellar atmospheres, 164, 179
Iron oxide
 in meteors, 218, 223, 225
"Iron rain" hypothesis, 230
Iron-silicon ratio
 in planetary matter, 220
Irregular clusters of galaxies, 2
Islands
 in stellar orbit theory
 see Chain of islands
Isolating integral, 117
Iso-tau layers
 in stellar atmospheres, 150
Isothermal atmosphere, 141
- Isothermal flow
 in H II region, 55
Isothermal ionization
 front, 51
Isothermal sound speed, 53
Isotropic expansion model
 of comets, 365
Isotropic scattering
 in stellar atmospheres, 171
Isotropy
 of distributions
 of galaxies, 15
Iteration schemes
 in stellar atmospheres, 177, 180-81, 186, 192-94
- J
- Jacobian transformation
 of coordinates
 useful in radar work, 384
Jeans instability lengths, 65
Jeans' theorem, 118
Jovian planets
 see Outer planets
Jupiter
 Hill's theory, 94, 111
 magnetic field and radio emissions, 299, 322, 379, 380, 399, 401-3
 mass, 102
Kapteyn's star group, 266-67
Kepler's third law, 103, 108, 381
Kirchhoff's law, 171
K line of Calcium II, 32, 152, 202, 204, 267
 135 km/sec expanding arm, 290
Kolb-Griem theory of atmospheres, 166
Kourganoff's analysis of stellar atmospheres, 180, 194
 4 kpc expanding arm, 288-90, 291, 292
Kramer's law, 178
Krook's analysis of stellar atmospheres, 181, 186, 195-96
Krypton
 in stars, 262
K stars, 255
 atmospheres, 155, 161
- L
- 10 Lac, 168
 Lagrangian equations
 in stellar orbit theory, 114

- Laplace equation
in stellar atmospheres, 147
- Laplace formula, 143
- Laplace transformation
in stellar model atmospheres, 141, 144, 181
- Late-type stars
atmospheres, 180, 206
in clusters, 248
- Layer of formation
see Mean layer of formation
- Lead
in planetary matter, 222
- Legendre polynomials
use of
in multipole expansion, 88
in model stellar atmospheres, 146, 173, 181
- Leiden map of galactic nucleus, 280, 287
- Lennard-Jones potential, 90
- α Leo, 237, 238, 240
- β Lep, 259
- Lewis correction
for electron impact broadening, 77
- L group of chondrites, 218, 219, 223, 230
- i Lib, 263
- Libration
lunar
radar studies, 391, 398
- Lick Astrographic Survey, I
- Light
velocity of, 99, 101, 103, 104, 108
- Light elements
in stellar atmospheres, 179
- Limb darkening, 138-39, 142-51
- Limiting frequency
in stellar atmospheres, 148
- Lindholm theory
for line broadening, 72, 79, 81, 82, 85
- Linearization
of stellar orbit equations, 122
see also Feautrier's linearization
- Linear polarization
criterion for, 308
- Line-blanketing, 238, 239, 240, 244, 263, 265, 269
- Line broadening, 71-92
Line of force, 116
magnetic, 332
- Line profiles, 71-92
see also specific elements
and specific lines
- Line spectrum
pressure effects, 154
- Line width, 151
- Liouville's theorem, 114
- Lissajous figures
box orbits as, 124
- LL group of chondrites, 218, 223
- Local association of stars, 252, 257
- Local galactic field of force, 120
- Local group of galaxies, 1, 3, 8
- Local standard of rest
see Local galactic field of force
- Local supercluster of galaxies, 18
- Local thermodynamic equilibrium, 137, 150, 152, 154, 155, 158, 161, 170-72, 201-2
departures from, 205-7
- Long-period variables, 271
see also Cepheids
- Loop structure
of supernova remnants, 56
- Lorentz classical collision theory, 73
see also Classical path theory
- Lorentz line profile, 77, 85
see also Phase-shift Lorentz profile
- Low velocity stars
in orbit theory, 118
- LTE
see Local thermodynamic equilibrium
- Luminosity class
in stellar atmospheres, 161
- Luminosity class II, 251
- Luminosity class III, 262
- Luminosity function
for cluster galaxies, 6, 15
- Lunar craters
see Rayed craters; Tycho
- Lunar eclipses
data for, 95
- Lunar inequality, 102, 105
- Lunar sine parallax, 102, 105
- α Lup, 257
- β Lup, 257
- \circ Lup, 257
- Lyman α
in model atmospheres, 202
profiles, 74, 76
- Lyman β
profiles, 73, 74, 75, 76
- Lyman limit frequency
in interstellar medium, 47
in stellar atmospheres, 187, 198, 238
- Lyman lines, 43
in model atmospheres, 158, 180
profiles, 76
- γ Lyr A, 265
- α Lyrae, 240
calibration, 28, 35, 40, 41, 43
model for, 168
- M
- M3, 270-71
- M5, 265, 266, 270
- M13, 265, 266, 268, 270
- M15, 269
- M39, 260
- M67, 267
- M62
radio observations, 299, 344
- M87, 5
radio observations, 299
- Mach numbers
in I fronts, 53
- Magma processes
in formation of the solar system, 230-31
- Magnesium
in planetary matter, 220, 223
- in stellar atmospheres, 164, 179, 204, 205
- Magnetic damping, 306
- Magnetic dipole moment, 369
- Magnetic eddies
in interstellar clouds, 58
- Magnetic fields
and bremsstrahlung, 297-350
- dipole, 322
- in galaxy, 343
- in interstellar medium, 62, 66-70
- in stellar atmospheres, 137, 261-62
- Magnetic separation processes
of primordial matter, 221
- Magnetic stars, 208, 261, 262
- Magnetobremstrahlung, 297-350
- Magnitude
of elliptical galaxy, 6-7
- Main sequence

SUBJECT INDEX

- see Pre-main sequence
contraction; Zero-age
main sequence
- Mariner II, 97, 98, 109
- Markov processes
fluorescence in comets
as, 360
- Mars
composition, 222, 226
mass, 102, 110, 111
radar observations, 379,
380, 399, 401
- Mass
stellar
in spectra, 35
- Mass losses
implications from stellar
atmospheres, 204
- Mass-luminosity relation,
241-48
- Mass motions
in interstellar medium,
61-62
- Matter distribution in space
in relation to galactic
clustering, 1, 15, 19
- Maximum depth
of spectral line
in stellar atmosphere,
157
- Maxwell velocity distribu-
tion
of electrons in H II regions,
45
- Mean brightness, 170
- Mean free path
of electrons in H II re-
gions, 49
- of interstellar gas clouds,
61
- Mean intensity, 170
see also Flux
- Mean layer of formation,
138
- Mean molecular weight
in stellar atmosphere,
189
- Mean temperature
of star, 138
- Measure
of orbit
see Available measure
- Mechanical heating
of interstellar medium,
61-65
- Mercury
composition, 226
mass, 102
perihelion precession,
387, 388
in planetary matter, 229
radar observations, 96,
111, 379, 380, 390,
399, 401, 404, 405, 406
- Meridian plane
in stellar orbit theory,
113
- Meridian stellar orbits,
120-23
- Meas on
radiation of, 306
- Metal abundances
in planetary matter, 220-
21
- in stellar atmospheres,
37, 38, 41, 155
- Metallic-line stars, 262
- atmospheres, 187, 211
spectra, 38
- Meteorites, 218, 219, 225-
26
as chemical tracers, 217-
34
- radar observations, 377
- Meteors
impacts on lunar sur-
face, 398
see also Planetary ob-
jects
- Meter wavelength observa-
tions
of galactic nucleus, 286
- Methane
in planetary matter, 229
- Method of characteristics
for expansion of gas cloud,
57
- 9 Mic, 259
- Milky Way
see Galaxy
- Mills Cross, 279
- Milne approximation, 174-
75
- Milne-Eddington model,
158
- Milne relations, 175-76,
180, 181, 188, 189,
201
- Mira stars, 249, 250
- Mixing length, 241
- Model stellar atmospheres,
135-216
- background, 138-68
black-body models, 138-
39
- coarse analysis, 156-60
- empirical models, 142-
54
- gas and electron in, 154-
56
- grid of models, 160-68
- intensity, 139-42
- construction, 168-201
- assumptions, 168-72
- Bohm-Vitense's method,
183-90
- equations, 172-77
- Feautrier's method, 190-
92
- iteration method, 192-
94
- moment method, 186-87
- numerical results, 197-
201
- opacity, 177-80
- opacity-dependent meth-
ods, 180-86
- Strömgren's method,
187-89
- variational methods,
194-97
- nonequilibrium models,
201-11
- departures from LTE,
205-7
- inhomogeneities and
turbulence, 207-10
- outer layers, 201-5
- summary, 210-11
- Molecular bands
in comets, 351, 356, 359-
65
- in stellar spectra, 29
see also particular mole-
cules
- Molecular hydrogen
in H I regions, 60
in H II regions, 55
see also Hydrogen
- Molecular scattering
in stellar atmospheres,
180
- Molecular weight
in stellar atmospheres,
169
- Moments
intensity
in stellar atmospheres,
172-76
- methods, 186-87, 189
- Momentum conservation
across I fronts, 51
- Monoenergetic electron
bremsstrahlung, 311,
317-18, 333, 344
- Moon
artificial satellite of, 99
- composition, 226
- ephemeris, 94
- mass ratio (to Earth),
102, 105
- mean distance, 102, 105
- mean motion, 98, 101,
103, 108
- radar studies, 377, 379,
386, 391-98, 399, 403
- angular scattering law,
394
- cross section, 392-94
- reflectivity variations,
394-98
- Morphology
of clusters of galaxies,
1-11
- Moving frames of reference
in particle orbit theory,
115, 119
- Mrkos, 351, 353, 355, 363,
364, 365, 366, 367,
368, 372, 373
- M stars, 248, 254

- Multiple-reflection point in radar, 391
- Multipole expansion in line-broadening theory, 88
- Multipole radiation, 301
- Mustel's method for opacities, 185
- N
- National Radio Observatory— 276, 281
- Nebulae
- Orion nebula, 56-58
 - see also Emission nebulae; H II regions; planetary nebulae
- Neon
- in H II regions, 47, 50
 - in planetary matter, 219, 227, 228, 229
 - in stars, 91
- Neptune
- mass, 102, 105
 - radar observations, 380
- Neutral atoms
- broadening by, 89-91
 - in plasmas, 326
 - in stellar atmospheres, 157
- Neutral hydrogen
- broadening by, 90, 91
 - in galaxy
 - see Galactic nucleus; H I region
- in Virgo cluster, 12
- Neutral region
- preceding I fronts, 55
- Neutrinos
- radiation of, 306
- Newton stars
- as energy sources, 64
 - see also Collapsed stars
- Newcomb, Simon
- precession constant, 100, 109
 - tables of the Sun, 109
 - theory of inner planets, 105
- Newtonian constant of gravitation, 99
- Newtonian time, 96
- Newton's method of tangents, 194
- NGC 188, 268, 269
- NGC 1039, 255
- NGC 2516, 255, 257
- NGC 4486, 299, 300
- NGC 4593, 275
- NGC 4674, 3
- NGC 4884, 3
- NGC 4889, 3
- NGC 7092, 260
- NGC objects
- distribution, 1
- Nickel
- in planetary matter, 220, 223
- in stellar atmospheres, 179
- Nitrogen
- in comets, 352
 - in planetary matter, 219, 228
 - in stellar atmospheres, 155, 164, 179
- Noble gases
- in planetary matter, 228
- Noise temperature
- in radar, 380
- Nonadiabatic electron impact theory, 79-80
- Noncoherent emission, 298, 315, 317
- Nongray line absorption, 186
- Nongray model atmospheres, 161-63, 176
- Nonlinearity
- of orbit equations, 122-23
 - of stellar atmospheres equations
 - see Feautrier's linearization
- Nonthermal processes
- criterion, 329
 - in galactic nucleus, 278, 285, 286, 290
 - see also Synchrotron radiation
- Northeast central galactic source, 281, 285, 288, 292
- "Nuclear disk" region of galaxy, 291
- Nucleosynthesis
- and formation of the solar system, 227
- Nutation constant, 94, 98, 100, 101, 109
- O
- Obliquity
- of ecliptic, 101, 103, 109
- Observational techniques for spectral fluxes, 29-34
- Octupole radiation, 301
- O II doublet
- in cluster galaxies, 2
 - in radio galaxies, 275
- Old stars, 265-71
- Olivine
- in meteors, 223
- Opacity
- in stellar atmospheres, 138, 139, 150, 152, 154, 155, 157, 172, 177-80, 182, 185, 187, 198
- Open clusters of galaxies
- see Irregular clusters of galaxies
- ω Oph, 259
- Optical bremsstrahlung, 300, 343-45
- Optical equipment for stellar spectra, 24-27
- Optical roughness in stellar atmospheres, 150
- Optical thickness
- in plasmas, 329, 342
 - in stellar atmospheres, 141, 155, 157
- Orbit theory of particles, 113-20
- box orbits, 123-25
- continuity equations and equations of motion, 113-15
- integrals of motion, 115-17
- meridian orbits, 120-23
- numerical solutions, 120-33
- periodic and tube orbits, 125-28
- quasi-ergodic orbits, 129-33
- third integral, 119, 120
- see also Planetary orbits; Stellar orbits
- Ordinary waves, 327
- α Ori, 248
- π Ori, 240
- 11 Ori, 259
- 49 Ori, 259
- 69 Ori, 257
- Orion nebula, 56-59
- age, 57
 - electron density, 57
 - evolution, 56
 - flow equations, 56
 - radio observations, 288
- Ornansite chondrites, 223
- Oscillation ellipse, 316
- Oscillations
- in stellar atmospheres, 210
- Oscillator frequency, 323
- Oscillators
- particles in fields as, 301-2
 - radar, 384
- Oscillator strengths, 87, 90, 91
- O stars
- atmospheres, 155, 167
 - calibration by, 28, 35, 38
 - in H II regions, 47
- Outer planets
- formation, 225
- Oxygen
- in comets, 352, 354, 355, 372
 - in H II regions, 47, 49, 50

SUBJECT INDEX

$\text{O}^18 - \text{O}^16$ ratio in chondrites, 218, 223, 227, 230
in stellar atmospheres, 155, 164, 179
see also O II doublet

P

Pair creation, 326
Palomar Sky Survey, 1
Parabolic approximation in model atmospheres, 149
Parabolic coordinates in stellar orbit theory, 120
Parallactic inequality, 102, 105
Parallax measurements for stellar spectra, 139
see also Spectroscopic eclipsing binaries; Trigonometric parallax

Parent bodies of planetary bodies, 225-27

Particle orbit theory see Orbit theory

Particular solutions in particle orbit theory, 115

Partition functions in stellar atmospheres, 177

Paschen lines in stellar atmospheres, 156, 167, 208
in stellar spectra, 28, 32, 76

Path loss in radar, 378, 379

α Pav, 257

λ Pav, 269

β Peg, 248

γ Pegasi, 43, 167, 168

Pencil beam surveys of galactic center, 285, 287

Perihelion precession of Mercury by radar, 387

Periodic orbits, 125-28

Permanence of clusters of galaxies, 11
see also Stability

α Persei, 257

δ Persei, 43, 257

e Persei, 257

ζ Persei, 168

η Persei, 248

\times Persei, 248

II Persei association, 252

α Persei cluster, 255, 257

Perseus arm, 248

Phase of oscillation of radiation, 314, 327

Phase-shift Lorentz profile, 72

Phase space, 114, 117

Phase velocity, 324

i Phe, 259

Phillips bands, 371

Phobos radar investigations, 380

Phosphorus in stars, 262

Photodissociation in comets, 357, 358, 361, 372

Photoelectric scanners for stellar spectra, 23-24, 27

Photographic photometry of galaxies, 6

Photoionization in H I region, 60
in H II region, 48

Photometric parallax, 244

Photometric techniques for galactic magnitudes, 5

Photon mean free path as parameter in front, 51

Photosphere "mean thickness," 144
observations, 151

Planck function, 170, 176

Planck law, 171

Planck mean absorption coefficient, 183

Plane-parallel atmosphere, 142, 170

Planetary masses, 102, 104, 105, 109-11

Planetary nebulae solutions by methods in stellar atmospheres, 201

Planetary objects chemical evidences pertaining to formation, 217-34

Planetary orbits radar studies, 384, 386, 387, 388

Planetary radii radar determinations, 384, 386, 387, 390, 404-5

Planetary rotation rates see Rotation rates

Planetary surface characteristics, 390-91, 399-403
see also Cross section; Dielectric constant; Reflectivity; Roughness

Planimetry in stellar spectra, 30

Plasma effect, 388, 401

Plasma frequency, 323

solar, 298

Plasmas electromagnetic waves in, 323-32
magnetobremstrahlung in, 331-32
radio waves in, 326-29
self-absorption in, 329-31

Pleiades, 43, 235, 241, 242, 243, 244, 247, 253-59, 262, 263, 265

Pleione, 254, 255, 258, 262, 265

Pluto mass, 102

Poincaré-Lighthill-Krook method for stellar atmospheres, 195, 196

Poincaré's theorem, 120

Point-by-point method of spectral scanning, 29-30

Points of self-intersection in orbit theory, 123

Point transformations in orbit theory, 119

Poisson brackets, 114

Poisson's equation, 114

Polar coordinates in stellar orbit theory, 120

Polarizability of atoms, 81, 88, 91

Polarization circular, 308
continuum in stellar atmospheres, 156
interstellar, 67
linear, 308
of magnetobremstrahlung, 300, 306, 311, 318-22
degree, 317
of radar signals, 384-86
see also Depolarization

Polarization ellipse, 316

Polyatomic molecules in comets, 357

Polynomial approximation in stellar atmospheres, 178

Population of atomic levels in stellar atmospheres, 205-7

of clusters of galaxies, 8-11
see also Stellar associations and particular clusters and regions

Positrons

- radiation of, 306
 Potential functions
 in stellar orbit theory, 115, 116
 see also Gravitational field
 Power law spectrum, 278, 286, 287, 288, 317-18, 333
 Praesep cluster, 265
 Precession
 general, 95, 98, 100, 107, 108
 Predissociation
 in comets, 370
 Pre-main sequence contraction, 204, 253
 Pressure
 see Electron pressure; Gas pressure
 Pressure broadening, 71
 see also Spectral line broadening
 Pressure scale height, 241
 Primary constant, 101, 103, 106
 Primordial matter, 217, 218-22
 Prior's rules, 218, 223
 Profiles of lines
 see Line profiles
 Proper motions
 effect
 on fundamental constants, 100
 in stellar evolution studies, 247, 253, 257
 Proper time
 delay
 in radar, 388
 Proton decay
 in magnetic fields, 306
 κ Psc, 259
 λ Psc, 38
 Pulsed transmitters, 380, 383
 σ Puppis group, 268, 269
 Pyroxene
 in meteors, 223
- Q**
- Quadratures
 integration by
 in stellar orbit theory, 126
 Quadrupole interaction
 in electron line broadening, 88-91
 Quadrupole moment
 of Sun, 387
 Quadrupole radiation, 301, 306
 Quantum defect method, 179
 Quasi-ergodic orbits
 in the Galaxy, 129-33
- Quasi-isolating integral, 117
 "Quasi-longitudinal" waves, 327
 Quasi-static theory
 of line broadening, 72, 76
 see also Adiabatic theory
 Quasi-steady flow
 across I fronts, 52
 Quasi-stellar radio sources, 299
- R**
- Radar astronomy, 377-410
 interpretation, 386-91
 fourth test of general relativity, 388-90
 planetary orbits and radii, 387
 planetary rotation, 390
 scale of solar system, 386-87
 target surface characteristics, 390-91
 lunar measurements, 391-98
 angular scattering law, 394
 background, 391-92
 cross section, 392-94
 variations in reflectivity, 394-98
 measurement types, 383-86
 cross section, 386
 delay Doppler shift, 384
 Doppler shift, 383
 polarization, 384-86
 time delay, 383
 planetary observations, 398-410
 astronomical unit, 403-4
 background, 398-99
 Earth-Venus distance, 97, 98, 108
 planetary orbits and radii, 404-6
 planetary surfaces, 399-403
 second-order Doppler shifts, 406-7
 Venusian rotation, 407-10
 techniques, 378-83
 detectability, 378-79
 systems, 379-83
 Radar fading
 see Interference fading; Short-period fading
 Radial pulsation
 of stars, 250
 Radial velocities
 of clusters galaxies, 2-5
 of comets
- see Heliocentric radial velocity
 of stars, 247, 250, 251, 270
- Radiation
 of electromagnetic waves, 300-5, 313-18
 in plasmas, 323-32
 see also Radiative equilibrium
 Radiation pressure
 effects on comets, 372
 Radiative equilibrium
 in stellar atmospheres, 35, 168, 169-70, 182, 196, 201
 deviations from, 201-11
 Radicals
 in comets, 351, 357, 359, 365, 366, 369, 371, 374
 Radii
 of planets
 see Planetary radii
 Radio emissions
 and galactic formation, 13
 from galactic nucleus, 275-96
 continuum, 277-88
 spectroscopic, 289-95
 Radio galaxies, 339
 see also specific galaxies such as NGC 4466
 "Radio star hypothesis," 299
 Radio waves
 in plasmas, 326-29
 Random motions in gases
 see Turbulent motions
 Range-Doppler mapping
 see Delay-Doppler dispersion
 Rare earths
 in planetary matter, 231
 Rare gases
 in planetary matter, 223, 227
 Rayed craters
 radar studies, 392
 see also Tycho
 Rayleigh-Jeans limit, 277
 Rayleigh scattering
 in infrared, 33
 in stellar atmospheres, 179
 Reabsorption
 see Self-absorption
 Recombination rate
 in H II regions
 see Cooling
 Reddening errors
 in stellar spectra, 37, 42
 Redshifts
 of cluster galaxies, 2-5
 see also Doppler shifts

SUBJECT INDEX

- Reference ellipsoid of revolution, 98, 104, 106
 Reflection nebulae, 61, 62
 Reflectivity
 radar, 378, 380, 390,
 391, 403, 404-6
 lunar, 392, 394-98
 see also Multiple-reflection
 Refractive index
 see Index of refraction
 Regular clusters of galaxies, 2
 Relativistic electron bremsstrahlung, 300-6
 self-absorption, 329-31
 Relativity
 see General relativity
 Renazzo chondrite, 219
 Resistor temperature, 277
 Resolution requirements
 in stellar spectra, 24-25
 see also Radar astronomy
 Resolving functional
 source function
 in stellar atmospheres, 194
 Resonance broadening, 90
 Resonance fluorescence
 in comets, 354, 358, 359-
 65, 367, 369, 372
 Response function
 in stellar spectra, 29
 Retardation effects, 91
 Retrograde rotation
 of Venus, 407-9
 R front, 51, 53-54
 R Hor, 268
 Rigid-sphere model
 of collisions
 in line broadening, 90
 Rocket measurements
 of stellar spectra, 45,
 237, 247
 Rosseland mean, 183, 185,
 190, 193
 Rosseland's theory of cycles
 applied to cometary fluorescence, 360
 Rotational broadening
 of spectral lines, 37
 Rotational effects
 on comets, 345
 on radar studies of planets,
 584
 on stars, 261, 262-63
 Rotational excitation
 of hydrogen
 in H II regions, 60
 of molecules
 in comets, 356, 359,
 360, 361, 367, 368,
 369, 370
 Rotation angle
 of plane of polarization, 348
 Rotation direction
 of plane of polarization,
 307, 326, 344
 Rotation measure
 in Faraday rotation, 67
 Rotation rates
 planetary
 radar determinations,
 386, 390, 407-9
 Roughness
 radar, 378, 385, 386,
 391
 RR Lyn, 263
 RR Lyrae, 37, 266
 RR Lyrae gap, 270
 RR Lyrae stars
 in evolution studies, 267,
 271
 spectra, 41, 42
 RS Ophiuchi, 202
 RS Per, 250
 R stars, 271
 RU Cam, 271
 Rudkjobing's theory
 of line broadening, 81, 85
 Russell-Adams phenomena, 158
- S
- Sagittarius A, 276, 281,
 287, 289, 292, 293,
 294
 Sagittarius arm of galaxy,
 285
 Saha equation, 150, 155,
 156, 157, 171, 182
 Satellite measurements
 of Earth's gravitational
 field, 96
 of Moon, 99
 of stellar spectra, 45
 radar, 386
 Saturn
 Hill's theory, 94, 111
 mass, 102
 radar observations, 380
 Scattering cross section
 in radar, 378
 see also Cross section
 Scattering function
 in radar, 378
 Schmidt optics
 in stellar spectra, 25
 Schmidt's potential function,
 124
 Schraffier pattern, 5
 Schraffier photography, 5,
 7
 Schuster-Schwarzschild
 model atmospheres,
 158
 α Scl, 263
 α Sco, 248
 μ Sco, 257
 τ Sco, 168
 Scorpio-Centaurus association, 252
 Scorpio-Ophiucus clouds,
 254
 Sculptor-type galaxies
 in Coma cluster, 8
 in local group, 7
 in Virgo cluster, 4, 14
 δ Scuti variables, 262,
 265
 Seaton's semiclassical
 theory
 of line broadening, 84
 Second, 97
 see also Ephemeris second
 Seki-Lines, 353, 355, 365,
 366, 368, 372
 Selected-wavelength scanning
 in stellar spectra, 29,
 33
 Self-absorption
 of magnetobremssstrahlung,
 329-31
 Self-broadening, 91
 Self-gravitating system
 of stars, 114
 Self-intersection points,
 123
 Semiclassical treatment
 of electron line broadening, 80-81
 α Ser, 168
 × Ser, 259
 Series representation
 for long-range interaction,
 90
 7 Sextantis, 38
 Seyfert galaxies, 275, 276
 Shell stars, 258
 Shock phenomena
 in formation of meteors,
 266
 in H II regions, 52-54
 Shock transitions, 53
 Shock-tube line profiles,
 74
 Short-period fading, 301
 Short-period variables,
 271
 see also Cepheids; RR
 Lyrae stars
 Silicates
 in planetary matter, 219,
 230
 Silicon
 in stellar atmospheres,
 157, 164, 167, 179,
 211
 Silicon-magnesium ratio
 in planetary matter,
 220-21
 Silicon stars, 258, 259
 Similarity solutions
 to dynamics of H II regions,
 55
 Similarity variables
 in dynamics of H II

- regions, 55
 Simplyconnected trajectories, 127
 Singularities
 in flow equations
 for I fronts, 56
 Sionite
 in planetary matter, 226
 Sirius group, 245-48, 260,
 263, 265
 binaries, 244
 Sodium
 in comets, 332
 D lines
 in comets, 372
 in stellar spectra, 32
 Soko-Banja group of chondrites
 see LL group
 Solar atmosphere
 H_α in, 91
 radio emission, 298, 326,
 331
 Solar day, 97
 Solar distance
 from Earth, 104, 107
 Solar eclipses
 data for, 95, 100
 Solar longitude, 103
 Solar mass, 98
 Solar mean time, 107
 Solar parallax, 94, 102,
 103, 106, 109
 Solar quadrupole moment,
 387
 Solar system
 chemical evidence of origin, 217-34
 fractionation processes, 227-31
 parent bodies of planetary objects, 225-27
 planetary matter, 222-25
 primordial matter, 218-22
 radar scale, 386-87
 Source function
 of radiation
 in stellar atmospheres, 141, 145, 147, 149,
 154, 206
 Southwest central galactic source, 283, 285, 288
 Spatial diffusion
 in plasmas, 377, 378
 Specific intensity, 139
 Specific mass, 169
 Spectral anomalies
 in stellar atmospheres, 164
 Spectral energy distribution
 bremstrahlung, 305,
 318-22
 of stars, 23-46
 calibration, 27-34
 cool stars, 37, 41
 effective temperature and gravity, 34-37
 hot stars, 41-43
 infrared measurements, 43-45
 instrumentation, 24-27
 ultraviolet measurements, 43-45
 Spectral index of radiation, 329, 337
 Spectral line broadening, 71-92
 Spectral lines
 see particular lines such as hydrogen-21 cm line
 Spectroheliometer, 138
 Spectrographs
 in stellar spectra, 24
 Spectroscopic-eclipsing binary, 35, 262
 Spectroscopic radio observations, 289-95
 hydrogen, 289-93
 S Per, 250
 Spherical atmospheres
 in model stellar atmospheres, 142
 Spherical harmonic method for determination of Earth's gravitational field, 96
 Spiral arms of galaxy bremstrahlung radiation in, 322
 see also specific arms such as 135 km/sec expanding arm; 4 kpc expanding arm
 Spiral galaxies, 275
 in clusters, 1-11
 see also specific galaxies
 SRc variables, 250
 Stability
 of clusters of galaxies, 13
 of interstellar medium, 63
 of oscillators
 in radar astronomy, 384
 Stable periodic orbits, 125
 Stäckel's standard form, 119
 Standard stars
 calibration for stellar spectra, 27-34
 Star
 see particular type such as B star and pulsar stars
 Star formation
 from interstellar matter, 62
 Stark broadening
 in stellar atmospheres, 156
 of hydrogen lines, 71-79
 Stark constant, 91
 Stark sublevels, 71, 72,
 76
 State temperature of gas, 293
 Stationary levels
 in stellar atmospheres, 205
 Statistical equilibrium in stellar atmospheres, 166, 205
 Stellar associations, 254
 and interstellar medium, 63
 see also particular associations
 Stellar atmospheres
 models, 135-216
 see also Model stellar atmospheres
 spectra in, 34-35
 Stellar evolution
 implications of model atmospheres, 204,
 211
 observational data, 235-74
 kinematics of young stars, 255-65
 mass-luminosity relation, 241-48
 old stars, 265-71
 young stars, 248-55
 zero-age main sequence, 235-41
 Stellar line profiles, 71
 Stellar luminosity function in clusters of galaxies, 12
 see also Stellar evolution
 Stellar masses
 effect on spectra, 35
 Stellar orbits, 113-34
 see also Orbit theory
 Stellar spectral energy distribution, 23-46
 see also Spectral energy distribution
 Stellar standards for galactic luminosities, 5
 Stimulated emission in plasmas, 329
 Stokes parameters, 313-18
 Stony meteorites, 219
 Stroboscopic method in stellar orbit theory, 128-29
 Strömgren opacity, 179
 Strömgren radius in H II region, 47
 Strömgren's theory of stellar atmospheres, 187-89
 Subclusters of galaxies, 13
 Subdwarfs, 267, 271
 atmospheres, 186

SUBJECT INDEX

- spectra, 37, 38, 40
 Subgiants, 267, 268-69
 SU Draconis, 37, 267
 Sulfides
 in planetary matter, 219,
 230
 Sun
 see Chromospheric re-
 gions; Coronal atmos-
 pheres; Solar
 SU Per, 250
 Superclusters
 of galaxies, 13, 16, 18-
 29
 Supergiants
 atmospheres, 158
 in clusters, 248
 Superior planets
 ephemerides, 97
 masses, 102
 see also particular plan-
 ets
 Supernovae
 as radio sources, 339
 see also Supernova remn-
 ants
 Supernova envelopes, 342,
 344
 Supernova remnants, 58-
 59, 64
 radio observation, 288
 see also particular rem-
 nants
 Supernova shells
 as energy sources
 in interstellar medium,
 47
 "Superthermal" particle,
 332
 Surface brightness
 of galaxy, 5
 of radio sources, 277,
 278
 Surface temperature
 of exciting stars
 in H II regions, 50
 Swan bands
 in comets, 352, 367, 368,
 369, 371
 Swan system
 of spectra, 353, 367,
 368, 369
 Swings effect, 359, 373
 Syke's formula, 143, 147
 Symmetrization in line-broad-
 ening theory, 52
 Synchrotron radiation, 278,
 288, 297-350
 as tracer of magnetic
 fields, 67
 Syrtis Major
 radar observation, 402
 SZ Cas, 250
- T
- β Tau, 240, 257
- 19 Tau, 263
 28 Tau, 254
 39 Tau, 30-31
 41 Tau, 259
 56 Tau, 259
 63 Tau, 165, 166, 168
 Taurus A
 radio emission, 299
 Taurus-Auriga clouds,
 259
 α Tel, 257
 Telluric emissions
 in comets, 372
 Temperature
 electron
 in H II regions, 49-51
 harmonic mean
 in H I regions, 60
 scale
 in stellar atmospheres,
 169
 in stellar spectra, 34
 see also Effective tem-
 perature; Mean temper-
 ature
 Temperature "equation"
 in stellar atmospheres,
 186
 Terrestrial planets
 see Inner planets and
 particular planets
 Thallium
 in planetary matter, 222
 Thermal conductivity
 see Conductivity
 Thermal equilibrium
 in comets, 358
 in stellar atmospheres,
 141, 171
 Thermal radio sources,
 277
 criterion, 329
 Third integral, 117, 120,
 129
 Thompson scattering
 in stellar atmospheres,
 170, 201
 Time average
 of radiation field, 314-
 15
 Time delay measurements
 in radar, 380, 383
 Titan
 radar observation, 380
 Titius-Bode law, 217
 Topography
 of planetary surfaces
 radar studies, 377, 385
 see also Planetary sur-
 face characteristics
 and individual planets
 Toroidal fields, 323
 T Per, 250
 Trace elements
 in planetary matter, 218,
 230-31
 Transfer problem
- in stellar atmospheres,
 137, 172, 184, 190,
 195, 206
 Transition probabilities
 conservation condition,
 73
 of species in comets,
 368
 see also Model stellar
 atmospheres and parti-
 cular atoms or mole-
 cules
 Triangulation measurements
 of solar system distances,
 387
 Trigonometric parallax
 of cluster stars, 244
 Tropical year, 97, 101
 Tschebyshev polynomials
 in model stellar atmos-
 pheres, 146
 T Tauri, 204
 T Tauri stars, 253
 Tube orbits, 125-28
 47 Tuc, 268, 271
 Turbulent motions
 in interstellar medium,
 62-64
 as energy sources, 64-
 66
 in planetary atmospheres
 effects on radar, 379
 in plasmas, 332
 in stellar atmospheres,
 207-10
 Turbulent pressure
 in stellar atmospheres,
 201
 Tycho, 395, 398
 Type I supernovae, 64
 Type II supernovae, 58,
 64
- U
- UBV system
 in stellar atmospheres,
 164, 166
 in stellar spectra, 32
 U Cep, 247
 Ultrarelativistic electron
 bremsstrahlung, 300-
 5
 Ultraviolet deficiency
 in early-type stars,
 238-40
 Ultraviolet excesses, 244,
 247, 259, 267
 Ultraviolet measurements
 in comet spectra,
 356
 in stellar atmospheres,
 151
 in stellar spectra, 43-
 45
 Ultraviolet radiation
 in stellar atmospheres,

- 150, 152
 β UMa, 265
 α UMa, 265
 ϵ UMa, 259, 260, 265
 α UMi, 255, 267
Underhill's iterative correct-ion method
for stellar atmospheres,
193-94
Uniform integral, 120
Uniformity
of chemical composition
in stellar atmospheres,
158
see Homogeneity
Universe
density of matter in, 19-
20
Unsöld's relation
in model stellar atmospheres, 193
Unstable periodic orbit,
125
see also Instability
U Oph, 247
Uranus
mass, 102
radar studies, 380
Ursa Major cloud of galaxies, 18
Ursa Major cluster, 248, 260
Utrecht Symposium
on abundances, 211
UV Ceti, 204
UY Per, 250
- V
- Van der Waals broadening,
89-91
Van Maanen-2, 168
Variable stars
spectra, 37
see also specific types
such as RR Lyrae stars
and particular stars
Variational methods
in stellar atmospheres,
- 181, 194-97
Velocity of light, 99, 101,
103-4, 108
Velocity-distance relation,
9
Velocity distribution function,
113-14
Velocity fields
in stellar atmospheres,
208-10
Venus
composition, 222, 226
mass, 98, 102, 111
radar observations, 96,
97, 377, 379, 380, 383,
390, 398-99, 401, 403-
6
rotation, 407-9
Vibrational excitation
of molecules
in comets, 367, 368,
369, 370, 372
 α Vir, 257
 ϵ Vir, 168
78 Vir, 259
Virgo A
radio emission, 299,
300
Virgo cluster of galaxies,
3-5
distance modulus, 4
luminosity, 5
total mass, 4
Virial theorem
in determination of mass,
4
Vogt-Russell theorem
in relation to stellar models, 136
VX Per, 250
VV Per, 250
- W
- Walters meteorite, 223
Water
in planetary matter,
229
in stellar atmospheres, 180
- Wave-zone approximation,
301
W Cep, 204
WC stars, 211
Weisskopf radius, 89
Wick-Chandrasekhar method
for stellar atmospheres,
189
Wing broadening, 72, 76-
78
WN stars, 211
Wolf-Rayet stars, 211
W Virginia stars, 271
- X
- Xenon
in planetary matter, 218,
227
X-ray bremsstrahlung, 299,
343-45
- Y
- Y Cyg, 247
Young stars, 248-65
kinematics, 255-65
YY Gem, 240
YZ Per, 250
- Z
- Zeeman splitting
of 21-cm line, 66
Zero-age main sequence,
235-41, 263
Zinc
in planetary matter,
229
Zone of expansion
of galactic nucleus, 290-
91
Zwicky interpolation formula
for number of galaxies,
5
Zwicky model
of galactic clustering, 1